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Original Research

Impacts of respiratory support methods on the prognosis of COVID-19 patients treated in the intensive care unit.

Prognosis of severe COVID-19 patients in the ICU

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Abstract

Aim: The goal of this study was to investigate the impacts of respiratory support methods and duration of intubation on the prognosis in COVID-19 patients treated in a tertiary care center's intensive care unit (ICU).

Material and Methods: The data was gathered from the medical files of 106 adult COVID-19 patients treated in the ICU of our tertiary care center for this retrospective analysis.

Results: The average age was 65.4 ± 14.9 years (24 to 93), and the rate of mortality was 64 .1 % (68 /106) in our series. The duration of ICU stay was 16.9±11.41 days (range: 1 to 60). The respiratory support methods used included continuous positive airway pressure (CPAP) (n=42, 39,6%), high flow nasal oxygen HF (n=28, 26.24%), urgent intubation (n=26, 24.5%), nasal oxygen support (n=6, 5,6%), and both CPAP and high flow nasal oxygen (n=4, 3,7%), respectively. No significant relationship was detected between prognostic outcome and duration of intubation (p=0.349), and duration of ICU stay (p=0.272).

Discussion: Critically ill patients with COVID-19 pneumonia have a high fatality rate. A well-established ICU and awareness of the implications of clinical data can maintain clinical standards and continue evidence-based practices that keep fatality rates low.

Keywords

COVID-19, Treatment, Prognosis

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This study was approved by the Ethics Committee of Clinical Research (Date:2020-10-27, No: 278)

Introduction

Around the world, the COVID-19 epidemic continues to be a major public health problem. Although the scientific understanding of COVID-19 is expanding by the day, there is a paucity of data on the characteristics and outcomes of patients who require ICU admission [1]. Several studies have found that certain factors may be linked to an increased risk of hospitalization and fatality in COVID_19 patients. Advanced age (>60 years), obesity (BMI > 30 kg/m^2), diabetes, hypertension, cardiovascular disease, a history of smoking, and chronic obstructive pulmonary disease (COPD) are just a few of them [2, 3].

At a high cost, the COVID-19 epidemic has taught us many significant medical, social, political, economic, and humane lessons. With a limited understanding of the virus, its transmission, community spread, and medical therapy of the disease at the time, our worldwide community's response was reactive and cautious. Non-peer-reviewed publications, case reports, and case series with insufficient and non-standardized data resulted in techniques and clinical management that were not scientifically sound, thus exposing patients to potentially nonbeneficial or even hazardous treatment strategies [4, 5].

Application of sound scientific evidence-based management principles distilled from decades of research in the past, with some adjustments in practices specific to COVID-19, mitigation strategies, and the careful application of disaster management principles in times of surge has resulted in better and superior outcomes. This is supported by the fact that, while outcomes have varied significantly amongst centers, they have generally improved over time, particularly when healthcare delivery systems are not overburdened [6, 7, 8].

Our expertise and comprehension of the virus, as well as the disease's therapy, are still evolving. We attempt to outline the progress made in a succinct yet thorough manner, as well as our predictions for future paths. The current study aimed to investigate the implications and correlation between prognostic outcomes and demographic, clinical, and laboratory features in critically ill COVID-19 patients admitted to ICU.

Material and Methods

This study was conducted utilizing data acquired from an electronic hospital database of a tertiary care facility. This study comprised a total of 106 adult COVID-19 patients (aged 24 or older) who were diagnosed with COVID-19 and admitted to the hospital's ICUs.

In addition to specific computed thoracic tomography findings, reverse transcriptase-polymerase chain reaction (RT-PCR) was used in all patients to confirm the diagnosis of COVID-19 disease.

Patients were admitted to our ICU if they met WHO criteria for severe pneumonia, which included a fever or suspected respiratory infection, as well as one of the following: a respiratory rate >30 breaths per minute, severe respiratory distress, or oxygen saturation of less than 90% on room air [9]. The researchers used evidence-based guidelines for acute respiratory distress syndrome (ARDS) and evolving consensus statements for COVID critical care management [10, 11, 12]. Based on procedures from small case series that have indicated short-term physiological increases in oxygenation, non-intubated oxygen-dependent patients were requested to adopt prone positioning (PP) for as long as tolerated [13, 14, 15].

Chronic comorbidities were chosen based on previously reported data utilizing pre-existing International Classification of Diseases classifications (ICD-10). Among the conditions were cardiovascular disease, lung disease, hypertension, diabetes, renal disease, liver disease, and a history of a solid malignant tumor. Our hospital was designated as a pandemic institution by the Turkish Ministry of Health (Sahra Hospital Affiliated with Dr Sadi Konuk Training and Research Hospital).

In this study, only COVID-19 patients who required an ICU stay were looked at. The study did not include patients under the age of 18, and pregnant women. The study followed the principles of Good Clinical Practice outlined in the Declaration of Helsinki. On admission and discharge, data on baseline demographic factors, comorbidities, interventions delivered, and hospital outcomes were collected. Patients were treated per local medical standards. All of the patients had either been discharged alive from the ICU or had died by the time the data was processed and the study conclusions were published.

Statistical analysis

Data were analyzed using Statistical Package for Social Sciences program version 21.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as means (standard deviations) and categorical variables were demonstrated as frequencies and percentages. Missing data were not imputed. Independent Samples and Kruskal-Wallis tests were used to compare variables between groups.

Outcome parameters

Age, BMI (kg/m²), comorbidities, smoking habits, vaccination history, prognostic outcomes, duration of ICU stay, and respiratory supportive methods were all collected from the hospital database.

Ethical Approval

This study was approved by the Ethics Committee of Clinical Research (Date: 2020-10-27, No: 278).

Results

In this study, we enrolled 106 patients treated in ICU who tested positive or negative for COVID-19. Baseline demographics, patient comorbidities and respiratory support methods interventions are summarized in Table 1. The average age was 65.4 ± 14.9 years (24 to 93), and the average BMI was 30.1 ± 6.6 kg/m2 (17.6 to 57.5). In this series, 74 patients (69.8%) had comorbidities while 32 cases (30.2 %) did not have any systemic diseases. Smokers constituted 15 % of the COVID-19 patient population (n=16) in ICU. 36 cases (33.9 %) had received at least one dose of the COVID-19 vaccine. The respiratory support methods used included continuous positive airway pressure (CPAP) (n=42, 39.6%), high flow nasal oxygen (n=28, 26.24%), urgent intubation (n=26, 24.5%), nasal oxygen support (n=6, 5.6%), both CPAP and high flow nasal oxygen (n=4, 3.7%), respectively.

Table 2 presents blood gas and monitor values at admission to the intensive care unit, duration of ICU stay, duration of ICU stay and mortality rate. The rate of mortality was 64.1 % (68/106) in our series. The duration of ICU stay was 16.9±11.41 days (range: 1 to 60). No significant relationship was detected

between prognostic outcome and duration of intubation (p=0.349), and duration of ICU stay (p=0.272). Table 3 shows no statistically significant difference was found in the average ICU hospitalization days of patients with or without comorbidities, smokers or non-smokers, vaccinated or non-vaccinated, positive or not detected in any PCR result, pathology detected in tomography or not.

Discussion

We aimed to compare the duration of intubation, duration of ICU stay and respiratory parameters in severe COVID-19 patients treated in the ICU with different prognostic outcomes. We noted that the duration of ICU stay was not affected remarkably by the respiratory supportive method.

COVID-19 pneumonia has a wide clinical spectrum, ranging from mild to life-threatening. Patients with COVID-19 pneumonia have only had their broad epidemiological results, clinical presentation, and clinical outcomes documented in previous investigations [16]. However, there is still a lack of information about critically ill patients. Data on the clinical features and outcomes of critically sick individuals infected with COVID-19 are sparse, yet they are crucial for lowering mortality.

Because there is currently no specialist medicine to treat COVID-19 infection, supportive care has remained the mainstay of treatment. Patients were being treated in isolation, and their immediate family and acquaintances were being quarantined. Individuals who are critically ill, on the other hand, require aggressive therapy and close monitoring. The patient numbers in three prior critically ill patient studies were insufficient to

Table 1. Baseline demographics, patient comorbidities and respiratory support methods

Baseline demographics and patient comorbidities n/N (%)		
Age (years) Mean±SD (Min-Maks)		65,4±14,9 (24-93)
Height (cm) Mean±SD (Min-Maks)		164,8±8,3 (150-180)
Weight (kg) Mean±SD (Min-Maks)		81,5±16,3 (50-140)
BMI Mean±SD (Min-Maks))		30,1±6,6 (17,6-57,5)
BMI n/N (%)	<30	61/106 (57,5)
	30-34,99	26/106 (24,5)
	35 and over	19/106 (17,9)
Comorbidity n/N (%)		74/106 (69,8)
Smoker n/N (%)		16/106 (15,0)
Vaccination n/N (%)		36/106 (33,9)
Any PCR positivity n/N (%)		90/106 (84,9)
Match PCR positiveness n/N (%)		
0		16/106 (15,0)
1		56/106 (52,8)
2		17/106 (16,0)
3		11/106 (10,3)
4		4/106(3,7)
5		2/106 (1,8)
Tomography Pathology n/N (%)		62/106 (59,0)
ICU Entube n/N (%)		79/106 (74,5)
ICU Extube n/N (%)		11/79 (14)
Respiratory Support Methods n/N (%)		
Urgent Intubation		26/106 (24,5)
Continuous Positive Airway Pressure (CPAP)		42/106 (39,6)
High Flow Nasal Oxygen(HF)		28/106 (26,4)
Nasal oxygen support		6/106 (5,6)
Both CPAP and HF		4/106 (3,7)

N: 106, BMI: Body Mass Index , PCR: Polymerase Chain Reaction, ICU: Intensive Care Unit, CPAP: Continous Positive Airway Pressure

Table 2. Blood gas and monitorization values at admission to the intensive care unit, duration of ICU stay, duration of intubation, complications and mortality rate

ICU Admission Blood Gas	Mean±SD (Min-Maks)
SpO2	83,7±16,8 (29,4-96)
pH	7,42±0,10 (7,12-7,6)
pCO2	42,7±12,7 (20,8-106)
pO2	66,7±34,4 (25,3-98)
Value on ICU Admission Monitor	Mean±SD (MinMaks)
SPO2	85,6±8,6 (56-93)
Siytolic TA	140,4±28,5 (60-240)
Diastolic TA	74,2±15,6 (30-160)
Pulse Rate	95,5±20,7 (56-160)
Respiratory Rate	30,5±8,1 (16-51)
The Rate of Mortality	(%) 64.1(68/106)
ICU Hospitalization (day)	16,9±11,4 (1-60) (p=0.272)
Duration of Intubation (day)	(1-17) (p=0.348)
Complication	**n/N (%)**
Pleural Effusion	16/106 (15,0)
GIS Bleeding	1/106 (0,9)
Pericardial Effusion	3/106 (2,8)
Emphysema	3/106(2,8)
Decubitus	3/106 (2,8)
GIS Bleeding	2/106 (1,8)
Pulmonary Embolism	1/106 (0,9)
Pneumothorax	1/106 (0,9)
DVT	1/106 (0,9)
Dialysis	2/106 (1,8)
Tracheostomy	5/106 (4,7)

ICU: Intensive Care Unit, DVT: Deep Vein Thrombosis, GIS: Gastrointestinal System,

Table 3. Blood gas and monitorization values at admission to the intensive care unit, duration of ICU stay, duration of intubation, complications and mortality rate

		ICU Hospitalization (day)			
		Mean±SD	Min- Maks	Median	P
Obesity	<30	18,4±12,5	4.60	16	0,466
	30-34,99	14,5±10,1	1.35	11,5	
	35 and over	14,3±6,6	5.26	12	
Comorbidity	No	18,6±14,0	4.60	16	0,684
	Yes	16,6±10,7	1.50	14	
Smoker	No	17,5±11,9	4.60	14	0,686
	Yes	18,8±13,2	1.50	16	
Vaccination	No	18,1±12,7	1.60	15	0,884
	Yes	17,2±9,6	4.50	15	
Any PCR positivity	No	24,7±16,7	1.60	28	0,05
	Yes	15,4±9,1	4.46	14	
Tomography Pathology	No	19,5±10,9	4.43	18	0,102
	Yes	15,9±11,5	1.60	13	

ICU: Intensive Care Unit, PCR: Polymerase Chain Reaction

summarize the characteristics and mortality of these COVID-19 pneumonia patients [2, 17, 18].

Severe ARDS is the basic pathophysiology of severe viral pneumonia. Men and people older than 65 years of age are more likely to acquire ARDS. As a result, it's plausible to assume that the death rate of severe COVID-19 pneumonia at 28 days is similar to that of severe ARDS, which is around 50% [19].

Critically sick patients with COVID-19 pneumonia have a significant fatality rate. Non-survivors are expected to live for 1–2 weeks after being admitted to the ICU. Patients over 65 years old with comorbidities and ARDS have a higher chance of death. The severity of COVID-19 pneumonia puts a strain on hospital critical care services, particularly if they are understaffed or under-resourced [16].

In our series, the ICU mortality rate was 64.1 %. This contrasts with ICU fatality rates reported in major case series from several countries varying from 30.9% to 49%. [20]. The disparities in ICU outcomes could be due to a variety of factors. To begin with, many patients remain in the ICU at the time of reporting 58% of patients in the Lombardy cohort [21] and 56.1 percent of patients in the New York case series [22]. Attempts to measure mortality early in the pandemic based on a limited set of patients with completed outcomes and a short follow-up period may skew statistical interpretation in favor of greater fatality rates.

In a more recent systematic evaluation of 15 trials, the pooled ICU mortality rate was found to be 25.7% which is comparable to the normal ARDS mortality rate of 35–45 percent [23].

Second, when compared to data from several major case series, our patients exhibited a decreased risk profile for severe disease. This could be due to discrepancies in ICU admission requirements. For ICU admission, we used the WHO criteria for severe pneumonia, although ICUs in overburdened healthcare systems may have used more strict admission criteria as part of rationing [24].

Graselli et al. found that older age, male sex, a high fraction of inspired oxygen, high positive end-expiratory pressure, or low PaO2:FiO2 ratio on ICU admission and a history of chronic obstructive pulmonary disease, hypercholesterolemia, and type 2 diabetes mellitus were all independent risk factors for mortality [21].

Having enough ICU staff was also crucial in ensuring that all patients got standard ICU care in accordance with ARDS and COVID-19 evidence-based guidelines. Prone positioning, a time-consuming procedure, was also performed on more than half of the ICU patients, which could not have been done due to a lack of ICU personnel [24].

Conclusion

Our study demonstrated the relationship between clinical and therapeutic characteristics and prognostic outcomes of COVID-19 patients admitted to an ICU in a tertiary care center. Even if powerful antiviral medicines are not yet widely available, low ICU mortality rates can be attained with good access to the ICU, early intubation, lung-protective ventilatory methods, and good general supportive care in the ICU. Severe COVID-19, on the other hand, has a high morbidity rate and can quickly deplete ICU resources in a pandemic. A well-established ICU and awareness of the implications of clinical data can maintain clinical standards and continue evidence-based practices without resorting to resource rationing, keeping fatality rates low.

Scientific Responsibility Statement
The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement
All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest
The authors declare that there is no conflict of interest.

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